HAMILTON. (HUGH)

The Chemical philosophy in remedy.

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SECOND DAY.

[*September 6, 1887.*]

Dr. TRAILL GREEN, President, in the Chair.

Dr. HUGH HAMILTON, of Harrisburg, Pa., read a paper on—

THE CHEMICAL PHILOSOPHY IN REMEDY.*

LA PHILOSOPHIE CHIMIQUE DANS LE REMEDE.

DIE CHEMISCHE PHILOSOPHIE IM HEILMITTEL.

BY HUGH HAMILTON, M. Sc., M. D., *Harrisburg, Pa.*

MR. PRESIDENT, LADIES AND GENTLEMEN: The activity in bacteriology and the advances in chemistry suggest that there is a chemical philosophy in remedy.

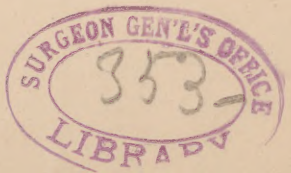
The lack of health may be termed disease. There is yet left the question, What is health? However, ill health may be divided into processes, at any time disturbing nutritive functions; or, secondarily, affecting them through traumatism.

The causes of disease have been a peculiarly tempting field for speculation in all ages. To name the numberless evanescent theories is unnecessary, because ingenious experiment has given a rational basis for etiology, insisting upon collective observation and the skillful use of instruments of precision, for determining the operation of physical law in, as well as without, the body.

Devotees of inorganic chemistry searched by analysis for the "elixir of life." To-day, organic chemical synthesis performs on a grand scale some metamorphoses not long since dependent alone upon vegetable physiology and the circumstances of climate and locality. While even the animal physiological economy is forced to contribute its share to supply the wasted abstract or approximate elements of the human body for use in medicine.

The theory of the genesis of disease is now traced to micrococci, which seems reasonable, and the multiplication of specific germs for diseases, when they occur synonymously, often permit great scope in generalization.

* "I. Disease Chemically Considered.
II. What is Remedy?
III. The part Chemistry plays in the Means of Cure. Illustrated by charts and diagrams." See Page 66. Abstract Programme Ninth International Medical Congress, Washington, D. C. 1887.



The brilliant deduction of Lister, from the investigation of Dr. Williams,* of London, in 1846, gave a practical impetus to this factor in disease.

The presence of masses of putrefying material, not among crowded human habitations, though filled with bacteria capable of producing disease, does not occasion sickness, while if oppositely situated may affect the organism.

Possibly these germs, to fulfil their life-cycle, require a longer or shorter residence in the body. The life-epoch may be slow or so rapid that the microscope, aided by electricity and photography, only can detect their changes.† They, when increased enormously, form *debris*, oppressing the function of the organs to dispose of it, thereby irritating the nervous system, creating the phenomena of fever, followed rapidly by other symptoms and signs of disorder.

I. The chemical constituents of these lowly forms, whether vegetable fungi or animalcules, are a cell wall of carbon or carbon-hydrogen, enclosing a liquid more or less rich in nitrogen, possessing the physical property of *endosmose* and the vital functions of assimilation and multiplication; as soon as *exosmose* takes place disintegration and death of the germ ensues.

During life these minute creations must either absorb carbonic gases or oxygen, as the case may be; to the human organism the result is the same; a certain degree of [carbonic acid gas] blood-poisoning.

Doubtless, then, germs are active in altering, by fermentation, the normal organic constituents of the blood into noxious ones, the result not unfrequently proving fatal. Exhibited in the following table:

Even their excessive life or extreme mortality exert similar influences, giving rise to the febrile movement, which may be defined as an irritation of the peripheral nerves, in turn acting inhibitorily upon a center supposed to be in the bulb, allowing unlimited vital activity.‡

Whether this irritation be applied to the skin, injected beneath it, absorbed by the receptive organs naturally, or through traumatic injury, increased appropriation of oxygen and expiration of carbonic acid gas is noted.

TABLE I.

Names.	Approximate Elements.	Chemical Formula.	Remarks.
Lipacidæmia, . . .	Oleic Acid		
Lipæmia, ...	Stearin	$C_{18}H_{36}O_2$	
Cholæmia, ...	Cholein	$C_{26}H_{44}O$	
Uræmia, ...	Urea	$2CH_4NO$	
Ammoniæmia, . .	Ammonia	NH_4O	
Acetonæmia,§ . . .	Acetone	$CH_3.CO.CH_3$	Di-*Methyl*-Ketone

* *Proceedings* Royal Soc. London, 1846, p. 1461.

† See article on Photographic Motion. *Century*, for July, 1887.

‡ On Fever. Prof. H. C. Wood. Phila.

§ Klinische Diagnostik innerer Krankheiten mittels bakteriologischer, chemischer und mikroskopischer Untersuchungsmethoden. Von Dr. Rudolph v. Jaksch. Wien und Leipzig, Urban & Schwarzenberg, 1887.

Exactly what the heat is caused by—a chemical action or reaction—is imperfectly known, *e. g.*—

1. ACTION $HO + SO_3$ evolves heat.

2. RE-ACTION $HO + SO_3 + NaOCO_x$ *evolves heat* and *gives off* an unseen product, carbonic acid gas.

Nevertheless, germs do lodge and multiply, compelling the organs to unwonted activity, develop fever and fermentive processes, cause inflammation inducing exudation, transudation and infiltration, until *hypertrophy* follows.

If, from some unknown cause, one organ neglects its duties, an *atrophy* is the consequence.

Germs appear to enjoy periods of prolific existence analogous to the vast zöological life-areas found in geology; the life epochs in scarlatina and variola seem to confirm this view, as they seldom again attack the system in such hordes.*

The commencement and progress of convalesence from fevers marks the decadence of this vast internal parasitic population, whose death-débris of extra quantities of carbon and nitrogen, etc., in whatever shape they may be presented for elimination, greatly tax the individual organs.

II. To assist in clearing the system of this life activity, or to aid in rapidly removing these effete bodies, constitutes the aim of remedy; so that REMEDY might be defined *as the use of means to restore the body to healthy condition by prophylaxis, repair of injury or the correction of nutrition.*†

Germs contain albumen; so, if subjected to the physical effects of vacuum, freezing, boiling or incineration, they suffer or perish. Chemically they succumb to the use of mineral acids, alkalies, certain salts and organic radicals. In a word, the deprivation of oxygen, either directly by oxidation of another substance capable of attracting and retaining it, by the loss of hydrogen, by the subtraction or substitution of elemental or approximate radicals. Consequently we can successfully exclude, arrest the development of, or totally destroy the bacteria. See Table III. Therefore, prophylaxis occupies hygienic thought, and is the expression of ideal medicine. What advances! The germ'discovery, disinfection, antisepsis, asepsis, vaccination with the attenuated virus, internal antisepticism and the addition of certain animal digestive ferments to assist assimilation and nutrition.

Surgery points with pride to the protection of injured parts *from active oxygen*, so that no bacteria can exist; therefore, absence of irritation; hence *no fever*.

The general constitution of the blood may be altered through the presence of bacteria, and of free or nascent oxygen, realizing the same conditions of fermentive action as exist in the pile of refuse, capable of originating such pathological changes as are noticed in several anæmias. (See Table I.)

One more step in the process and we are introduced into the domain of partial and complete disintegration.

The ptomaines engendered by bacteria are divided into several classes, and upon subsequent elemental analysis show that they contain certain homologues of organic radicals.‡ See Table II.

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*Drs. Edes & Jameson, in July number *Brit. Med. Jour.*, 1887.

†Several Medical Journals in their reports attributed this definition of remedy to European sources, it is not so. It is my own.—H. H.

‡Remsen's Theoret. Chemistry, 1887, 3d rev. ed. "Animal alkaloids," Aitken, Lond., 1887. "Ptomaines," Brown, Lond., 1887.

TABLE II.

Ptomaines.	Chemical Formula.
Choline, ...	$C_5H_{15}NO$
Neuridine, ...	$C_5H_{14}N_2$
Cadaverine, ...	$C_5H_{16}N_2$
Putrescine, ...	$C_5H_{12}N_2$
Saprine, ...	$C_5H_{16}N_2$
Tri-*Methyl*-Amine, ...	$(CH_3)_3N$
Mydaline, ...	

Cornil et Babes, "Les Bacteries," Paris, 1887, p. 57.

The application of disinfectants suggested antiseptics, and leads us to anticipate their modified use in internal medicine.

TABLE III. *A-septics and anti-septics. By Duclaux.**

Chemical Formula.	$\frac{1}{100000}$ in 1 of Liquid. Substance.	Amount to stop development of germs.	Amount *not* sufficient to stop development.	Amount required to destroy the germs.	Amount in which germs could live but not multiply.	Amount required to preserve 1000 of soup.	Amount which would not preserve 1000 of soup.
$HgCl_2$.	Corrosive Sublimate, ...	40	20	170	154	80	66
Cl.	Chlorine, ...	33	24	44	33	2,320	2,170
CaCl.	Calcium Chlorid, 80°, ...	90	76	268	224	5,880	3,875
SO_2.	Sulphurous Acid, ...	155	117	500	200	5,265	3,660
SO_3.	Sulphuric Acid, ...	170	120	500	300	8,620	4,900
Br.	Bromine, ...	155	126	392	250	2,975	1,820
I.	Iodine, ...	200	150	646	500	2,440	1,916
Al_2O_3 + A.	Acetate of Alumina, ...	235	184	2,350	1,200	15,620	10,870
	Ess. of Mustard, ...	300	175	1,690	1,220	35,700	25,000
	Acid Benzoic, ...	350	250	2,440	1,960	8,265	4,760
	Borax-Sal., ...	350	264	13,890	9,090	33,330	20,000
	Picric Acid, ...	500	230	1,000	700	6,660	5,000
	Thymol, ...	145	450	9,175	4,715	50,000	27,780
	Salicylic Acid, ...	1,000	893	18,660	12,820	. . .	28,570
	Pot. Permang, ...	1,000	700	6,060	5,000	6,660	5,000
	Carbol, ...	1,500	1,000	45,450	23,810	376,000	250,000
	Chloroform, ...	11,110	8,930	8,930	7,460	. . . . .	1,250,000
	Borax, ...	15,140	12,990	20,830	14,500	. . . . .	83,350
	Alcohol, ...	47,620	28,570	227,300	116,600	. . . . .	847,000
	Eucalyptol, ...	71,400	50,000	8,900	4,800	. . . . .	171,570

III. Clinical experience has shown that remedies, although often empirically selected, are those containing efficient oxidizers, active appropriators of hydrogen, or by the substitution of radicals succeed in destroying the pernicious products of the germ, its spores, or the consequences of its mere existence in the vital fluid, *e. g.*, acetanilid, salol, quinine, *atropine*, and a host of others.

*Cornil et Babes, "Les Bacteries" Paris 1886, p. 46.

These facts, drawn from the domain of theory and the field of practice, bring to view an outline for the *philosophy* in the choice of *remedial* agents. When the exact laws of *physics* and *chemistry* are intelligently and successfully used to *restore nutrition*, the study of medicine will possess additional charms and the practice become a recreation.

Discussion.

Dr. Wm. Murrell. (London, Eng.) The subject is one of great interest. The branch of investigation is important, but there are very few workers in it. The contributions of Dr. Wormley in this country, and Dr. Stockman in Edinburgh, I regard as of special value.

Dr. Ralph Stockman. With regard to the part played by *ptomaines* in causing the symptoms in infectious diseases, I may here refer to some recent work by Dr. Phillip, of Edinburgh, on the formation of *toxic* bodies in phthisical cavities. He finds that if *phthisical sputum* be kept at the body temperature for some hours, and then treated by the Stas-Otto method for the separation of alkaloids, there is obtained an *alkaloidal* body which is an *active poison.*

This substance administered to frogs caused rapid general paralysis and slowing of the heart. In mammalia, a very large dose caused death, while small doses frequently repeated induced emaciation, rapid loss of weight and fever. One of the most interesting parts of the investigation is the fact that the toxic action of this body is, to a very large extent, antagonized by atropine, and this may account for the large use of *atropine* and *belladonna* in the treatment of phthisis. It seems probable that further investigation will prove that in most of the infective fevers the symptoms are largely the result of ptomaine formation, and that the ptomaines result from the decomposition of albuminous matter by germs.

Dr. J. G. S. Coghill. (Ventnor, Eng.) The interesting fact just mentioned, showing antagonism between *atropine* and the products of the *bacillus tuberculosis*, receives some corroboration, clinically, since patients suffering with phthisis will bear much *larger doses of belladonna* without producing toxic symptoms than they could in health. It is by working on *this line* that we will attain to a really *scientific* treatment of disease.